

# Hypoanthraconaia: a new genus of non-marine bivalve molluscs from the Early Permian of Far East Russia

Silantiev V., Urazaeva M.

Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

---

## Abstract

© 2016, Paläontologische Gesellschaft. Early Permian continental deposits include a large number of localities containing anthracosiid-like non-marine bivalves traditionally assigned to *Anthraconaia* Trueman and Weir, 1946, *Palaeonodonta* Amalitzky, 1895, and *Palaeomutela* Amalitzky, 1892. In most cases, these classifications are only tentative due to insufficient preservation in which the shells are missing their main characteristics: the ligament and the hinge. Non-marine bivalves from the Early Permian Upper Pospelovka Subformation of Russky Island (South Primorye, Far East Russia), described here as *Hypoanthraconaia* gen. nov., differ morphologically from the above genera by a set of external features including the initial shell, the mode of intersection of the growth lines with the dorsal margin, and the details of the sculpture. *Hypoanthraconaia* gen. nov. shows the most external similarity with “atypical” anthracosiid-like morphotypes of *Anthraconaia* that are widespread in the Late Pennsylvanian and Early Permian of eastern North America, and the Stephanian and Early Permian Lower Rotliegend of northwestern Europe. On this basis, the new genus is conventionally assigned to the family Naiaditidae Scarlato and Starobogatov, 1979.

<http://dx.doi.org/10.1007/s12542-016-0334-4>

---

## Keywords

Early Permian, Naiaditidae, Non-marine bivalves, Russia, Russian Far East

## References

- [1] Amalitzky, V.P. 1892a. Materialy k poznaniyu fauny permskoi sistemy Rossii: 1. Mergelisto-peschanye porody Oksko-Volzhskogo basseina. Anthracosidae. Izvestiia Varshavskogo Universiteta 2-5(7-8): 1-150. (in Russian).
- [2] Amalitzky, V.P. 1892b. Über die Anthracosien der Permformation. Russlands Palaeontographica 39(4-6): 125-214.
- [3] Amalitzky, W.P. 1895. Comparison of the Permian freshwater Lamellibranchiata from Russia with those from the Karoo System of South Africa. Quarterly Journal of the Geological Society 51(1-4): 337-351.
- [4] Bambach, R.K. 1973. Tectonic deformation of composite-mold fossil Bivalvia (Mollusca). American Journal of Science 273A: 409-430.
- [5] Betekhtina, O.A. 1966. Verkhnepaleozoiskie nemorskie peletsipody Sibiri i Vostochnogo Kazakhstana. Moskva: Nauka. (in Russian).
- [6] Betekhtina, O.A. 1972. Osnovnye printsiipy sistematiki nemorskikh dvustvorchatykh molliuskov. Trudy Instituta Geologii i Geofiziki Sibirskogo Otdeleniia Akademii nauk SSSR 112: 59-65. (in Russian).
- [7] Betekhtina, O.A. 1974. Biostratigrafiia i korreliatsiia uglenosnykh otlozhenii pozdnego paleozoi po nemorskim dvustvorkam. Novosibirsk: Nauka. (in Russian).
- [8] Betekhtina, O.A., and P.A. Tokareva. 1988. Nemorskie dvustvorki. In: Verknii paleozoi Angariy. Fauna and flora, 59-71. Novosibirsk: Nauka (in Russian).
- [9] Beurlen, Karl. 1944. Beiträge zur Stammesgeschichte der Muscheln. Mathematisch-Naturwissenschaftlichen Abteilung der Bayerischen Akademie der Wissenschaften zu München. Sitzungsberichte 1-2: 133-145.
- [10] Bradshaw, M.A. 1984. Permian nonmarine bivalves from the Ohio Range Antarctica. Alcheringa 8: 305-309.

- [11] Burago, V.I., A.V. Kiseleva, G.V. Kotlyar, A.P. Nikitina, M.I. Sosnina, and S.M. Taschi. 1974. Paleontologicheskaya kharakteristika permskikh otlozhenii luzhnogo Primor'ia. In *Paleozoi Dal'nego Vostoka*, eds. L.I. Krasnyi, L.I. Popeko, 214–235. Khabarovsk: Far East Scientific Centre, Academy of Science USSR (in Russian).
- [12] Cadée, G.C. 2002. Floating articulated bivalves, Texel, North Sea. *Palaeogeography, Palaeoclimatology, Palaeoecology* 183: 355–359.
- [13] Carter, J.G., C.R. Altaba, L.C. Anderson, R. Araujo, A.S. Biakov, A.E. Bogan, D.C. Campbell, M. Campbell, J.C.W. Jin-hua Chen, G. Cope, H.H. Dijkstra Devlene, R.N. Zong-jie Fang, V.A. Gardner, I.A. Gavrilova, P.J. Goncharova, J.H. Hartman Harries, M. Hautmann, W.R. Hoeh, J. Hylleberg, P. Bao-yu Jiang, L. Johnston, K. Kirkendale, J. Kleemann, J. Koppka, D. Kříž, N. Machado, A. Malchus, J.-P. Márquez-Aliaga, C.A. Masse, P.U. McRoberts, S. Middelfart, L.A. Mitchell, S. Nevesskaja, J. Özer, I.V. Pojeta, J.M. Polubotko, S. Pons, T. Popov, A.F. Sánchez, R.W. Sartori, I.I. Scott, J.H. Sey, V.V. Signorelli, P.W. Silantiev, T. Skelton, J.B. Steuber, G.L. Wingard Waterhouse, and T. Yancey. 2011. A synoptical classification of the Bivalvia (Mollusca). *Paleontological Contribution University Kansas* 4: 1–47.
- [14] Chang, J. 1988. Correlation of lower Permian series of terrestrial facies in west part of Tarim Platform. *Xinjiang Geology* 6: 2–14.
- [15] Cocks, L.R.M., and T.H. Torsvik. 2007. Siberia, the wandering northern terrane, and its changing geography through the Palaeozoic. *Earth-Science Reviews* 82: 29–74.
- [16] Dawson, John W. 1860. Supplementary chapter to the first edition of “Acadian geology [microform]: an account of the geological structure and mineral resources of Nova Scotia and portions of the neighbouring provinces of British America”. Edinburg: Oliver and Boyd, Tweeddale Court.
- [17] Durante, M., and S. Pukhonto. 1999. Upper Permian of Angaraland (series and stage boundaries). *Permophiles* 34: 26–31.
- [18] Eagar, R.M.C. 1975. Some nonmarine Bivalve faunas from the Dunkard group and underlying measures. In *The Age of the Dunkard. Proceedings of the First I. C. White Memorial Symposium*, ed. J.A. Barlow, 23–67. Morgantown: West Virginia Geological and Economic Survey.
- [19] Eagar, R.M.C. 1984. Late Carboniferous–Early Permian nonmarine bivalve faunas of northern Europe and eastern North America. In *Compte Rendu Neuvième Congrès International de Stratigraphie et de Géologie de Carbonifère*, 559–576. Washington and Champaign-Urbana.
- [20] Eagar, R.M.C. 1994. Discussion of ‘classification of Carboniferous non-marine bivalves: systematic versus stratigraphy’ by G.M. Vasey. *Journal of the Geological Society* 151: 1030–1033.
- [21] Eagar, R.M.C. 2005. Non-marine and limnic bivalves. *Courier Forschungsinstitut Senckenberg* 30: 55–85.
- [22] Eichwald, C.E. 1860. *Lethaea Rossica ou Paléontologie de la Russie, Décrite et Figurée par Edouard d'Eichwald*. E. Schweizerbart, Stuttgart. Vol. 1: Ancienne Période, 1–26 + xix + 1–32 + 33–1657.
- [23] Golonka, J., and A. Gawęda. 2012. Plate tectonic evolution of the southern margin of laurussia in the Paleozoic, tectonics—recent advances, ed. Evgenii Sharikov. <http://intechopen.com/books/tectonics-recent-advances/plate-tectonic-evolution-of-the-southern-margin-of-laurussia-in-the-paleozoic>.
- [24] Gusev, A.K. 1963. Znachenie dvustvorchatykh molliuskov dlya raschleneniya i korreliatsii krasnotsvetnykh otlozhenii verkhnei permi vostoka Russkoi Platformy. *Kazanskii Universitet, Uchenye Zapiski* 123(5): 15–25. (in Russian).
- [25] Gusev, A.K. 1990. Nemorskie dvustvorchatye molliuskii verkhnei permi Evropeiskoi chasti SSSR. Kazan: Kazanskii Gosudarstvennyi Universitet. (in Russian).
- [26] Hertwig, Richard. 1895. *Lehrbuch der Zoologie*, ed. 3. Jena: Gustav Fischer, xii + 1–599.
- [27] Khalfin, L.L. 1950. Platinchatozhabernye Molliuskii Uglenosnykh Otlozhenii Kuzbassa. *Akademiia Nauk SSSR, Zapadno-Sibirskiy Filial, Gorno-Geologicheskii Institut, Trudy* 9: 1–159. (in Russian).
- [28] Kotlyar, G.V., O.L. Kossovaya, A.V. Zhuravlev, S.B. Shishlov, and S.K. Pukhonto. 2004. Boundary between Permian series in diverse sedimentary facies of North European Russia: constraints of event stratigraphy. *Stratigraphy and Geological Correlation* 12(5): 460–484.
- [29] Kotlyar, G.V., G.C. Belyansky, V.I. Burago, A.P. Nikitina, YuD Zakharov, and A.V. Zhuravlev. 2006. South Primorye, Far East Russia—a key region for global Permian correlation. *Journal of Asian Earth Sciences* 26: 280–293.
- [30] Lahusen, I.I. 1897. *Kratkii kurs paleontologii*. Tom 2. Paleozoologiya. St Petersburg: Izdatel'stvo Akademii Nauk. (in Russian).
- [31] Lucas, S.G., and L.F. Rinehart. 2005. Nonmarine bivalves from the Lower Permian (Wolfcampian) of the Chama Basin, New Mexico. *New Mexico Geological Society, 56th Field Conference Guidebook* 283–287.
- [32] Lucas, S.G., J.W. Schneider, and G. Cassinis. 2006. Non-marine Permian biostratigraphy and biochronology: an introduction—Non-Marine Permian Biostratigraphy and Biochronology. *Geological Society. Special Publications* 265: 1–14.
- [33] McAlester, A.L. 1962. Mode of preservation in early Paleozoic pelecypods and its morphologic and ecologic significance. *Journal of Paleontology* 36: 69–73.
- [34] Netschaev, A.V. 1894. Fauna permskikh otlozhenii vostochnoi polosy Evropeiskoy Rossii. *Trudy Obshchestva estestvoispytatelei pri Kazanskom Universitete* 27: 503. (in Russian).
- [35] Pruvost, P. 1930. La Faune continentale du terrain Houiller de la Belgique. *Mémoires du Musée Royal d'Histoire Naturelle de Belgique* 44: 218–256.
- [36] Pukhonto, S.K. 1998. Stratigrafiia i floristicheskaya kharakteristika permskikh otlozhenii ugol'nykh mestorozhdenii Pechorskogo basseina. Moskva: Nauchnyi mir. (in Russian).
- [37] Ragozin, L.A. 1935. Peletsypody Balakhonskoï svity Kuzbassa. *Tomskii Universitet, Trudy, Seriya Geologicheskaya* 88: 54–74. (in Russian).
- [38] Rinehart, L.F., and S.G. Lucas. 2011. Nonmarine bivalves Unionoida, Anthracosidae from the Early Permian Wolfcampian Sangre de Cristo Formation in north-central New Mexico. *Bulletin—New Mexico Museum of Natural History and Science* 53: 143–148.
- [39] Rinehart, L.F., and S.G. Lucas. 2013. A population of Antediplodon dockumensis (Bivalvia, Unionoida, Hydridae) from the Revueltian (Upper Triassic; early-mid Norian) Bull Canyon Formation of West Texas; growth, allometry, productivity, and ecology. *Bulletin—New Mexico Museum of Natural History and Science* 61: 500–523.
- [40] Salter, J.W. 1861. On the fossils of the South Wales. In *Iron Ores of Great Britain, Part III, Iron Ores of South Wales*. Memoirs of the Geological Survey. Great Britain. 219–236.
- [41] Scarlato, O.A., and Y.I. Starobogatov. 1979. Osnovy cherty evoliutsii i sistema klassa Bivalvia. In *Morfologiya, Sistematika i Filogeniya Molliuskov*. Akademiia Nauk SSSR, Trudy Zoologicheskogo Instituta 80: 5–38. (in Russian).
- [42] Schäfer, W. 1972. *Ecology and Palaeoecology of Marine Environments*. Chicago: Chicago Press.

- [43] Schneider, J.W., S.G. Lucas, and J.E. Barrick. 2013. The Early Permian age of the Dunkard Group, Appalachian basin, U.S.A., based on spiloblattnid insect biostratigraphy. *International Journal of Coal Geology* 119: 88-92.
- [44] Silantiev, V.V. 2014. Permian Nonmarine Bivalve Zonation of the East European Platform. *Stratigraphy and Geological Correlation* 22(1): 1-27.
- [45] Silantiev, V.V., and J.G. Carter. 2011. On changes in taxonomy of non marine bivalve molluscs of the Late Paleozoic in the "Treatise on Invertebrate Paleontology," 3rd ed. *Bulletin Moskovskogo Obshchestva Ispytatelei Prirody. Otdelenie Geologii* 86(1): 14-17.
- [46] Silantiev, V.V., and J.G. Carter. 2015. Permian non-marine bivalves Palaeonodonta Amalitzky, 1895: the position in the modern system of Bivalvia. *Paleontological Journal* 49(10): 1125-1141.
- [47] Silantiev, V.V., and M.N. Urazaeva. 2013. Shell Microstructure in the Permian Nonmarine Bivalve Palaeomutela Amalitzky: revision of the Generic Diagnosis. *Paleontological Journal* 47(2): 139-146.
- [48] Silva-Pineda, A., B. Buitrón-Sánchez, J. Arellano-Gil, D. Vachard, and J. Ramírez. 2003. Permian Continental and Marine Biota of South-Central Mexico: a Synthesis. *Memoirs American Association of Petroleum Geologists* 79: 83-86.
- [49] Simoes, M.G., F. Quaglio, L.V. Warren, L.E. Anelli, P. Stone, C. Riccomini, C.H. Grohmann, and M.A.C. Chamani. 2012. Permian non-marine bivalves of the Falkland Islands and their palaeoenvironmental significance. *Alcheringa* 36(4): 543-554.
- [50] Stone, P. 2012. Devonian and Permian fossils from the Falkland Islands in the biostratigraphy collection of the British Geological Survey. Nottingham: British Geological Survey.
- [51] Stratigraphic Code of Russia. 2006. Third edition. Sankt-Peterburg: VSEGEI Press.
- [52] Trueman, A.E., and J. Weir. 1946. The British Carboniferous non-marine Lamellibranchia. Part. 1. *Paleontological Society Monograph* 99 (434):i-xxxii (1-8).
- [53] Vokes, Harold E. 1967. Genera of the Bivalvia: A systematic and bibliographic catalogue. *Bulletins of American Paleontology* 51(232):[103-111] + 112-394.
- [54] Weir, J. 1938. On a second collection of fossils and rocks from Kenya made by Miss M. McKinnon Wood. II. Palaeonodonta from Kenya and Burma. *Monographs of the Geological Department of the Hunterian Museum* 12-15.
- [55] Weir, J. 1960. The British Carboniferous Non-Marine Lamellibranchia Part 10. *Palaeontographical Society Monographs* 113(489): 273-320.
- [56] Weir, J. 1966. The British Carboniferous Non-Marine Lamellibranchia Part 11. *Palaeontographical Society Monographs* 119(510): 321-372.
- [57] Weir, J. 1967. The British Carboniferous Non-Marine Lamellibranchia. Part 12. *Palaeontographical Society Monographs* 121 (517): 373-413.
- [58] Weir, J. 1969a. Family Myalinidae Frech, 1891. In *Treatise on Invertebrate Paleontology. Part N, 1. Mollusca 6, Bivalvia*, ed. R.C. Moore, 291-295.
- [59] Weir, J. 1969b. Superfamily Anthracosiacea Amalitzky, 1892. In *Treatise on Invertebrate Paleontology. Part N, 1. Mollusca 6, Bivalvia*, ed. R.C. Moore, 404-411.
- [60] Zakharov, Y.D., A.V. Oleinikov, G.V. Kotlyar, V.I. Burago, V.S. Rudenko, and E.A. Dorukhovskaya. 1999. First find of Early Permian goniatite southern Primorie. *Geology of Pacific Ocean* 14: 805-816.
- [61] Ziegler, A.M., M.L. Hulver, and D.B. Rowley. 1997. Permian world topography and climate. In *Late glacial and postglacial environmental changes: Pleistocene, Carboniferous-Permian, and Proterozoic*, 111-146. Oxford: Oxford University Press.
- [62] Zimina, V.G. 1967. About Glossopteris and Gangamopteris from Permian deposits of South Primorye. *Paleontological Journal* 2:113-121
- [63] Zimina, V.G. 1977. Flora rannei i nachala pozdnei permi luzhnogo Primor'ia. Moskva: Nauka. (in Russian).